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20TH ANNUAL TEST & EVALUATION CONFERENCE

Quality Evaluation (QE)

A Method for Independent Test and Evaluation of In-Service Munitions

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NAVAL ORDNANCE SAFETY & SECURITY ACTIVITY

- **NOSSA:** The Department of the Navy Technical Agent and Program Manager for Explosives Safety
  - Responsible for Weapons & Ordnance Explosive Safety Programs (ESP) and Related Environmental Matters
  - Program Management/Execution of DoN/CNO Explosives Safety Programs (WSESRB, OS, OE, IM, & **QE**)
- Overarching Goal:

Enable/Optimize DoN/National Combat Capability With Minimum Risk & Maximum Fleet Confidence

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NOSSA CORE RATIONALE

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QUALITY EVALUATION (QE)

- Independent Test, Evaluation, and Analysis of In-service Weapons & Ordnance for **Changes** that Impact:

  Safety, Reliability, and Performance

- Determination and Prediction of Safe & Reliable Service, Usage, or Storage Lives for the Fleet and for the Design and Acquisition Communities
- **QE Program's Goal:**

Prevent the Fleet From Being the Point of Detection of Failures

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CONFERENCE THEME RELATIONSHIP

"Defense Operational Test & Evaluation:
Twenty Years and Counting:
Doing OT&E Better After 20 Years of Practice"

Navy Weapons and Ordnance Quality Evaluation Program is 60 Years Old and **Improving**

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QE ORIGINAL MANDATE

- **BUORD ORDER NO. 23-44 (6 July 1944):**

  "Adequate inspections and tests shall be made of components and complete assemblies of all types of munitions throughout the stages of design and development, production, assembly, storage both afloat and ashore, and subsequent to any modification or overhaul; in order **to insure** the supply of satisfactory munitions to using activities as well as the continued serviceability and optimum performance of such munitions."

- **The Mandate Continues via SECNAV & OPNAV**

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WHY QE?
(RATIONALE: ASSURED LONG LIFE)

- **Navy Stockpile is Old & Getting Older**
  - Typical Design Life of Weapons/Ordnance ~ 5 - 8 Years
  - Average In-Service Age of Stockpile ~ 25 Years
  - Navy In-Service Inventory Valued at ~ $38 Billion
- Weapons/Ordnance Degradation (Aging) Will Occur
  - Age Induces Chemical/physical Changes
  - Environmental Stressors (In-Service Use)

To Prevent Fleet Failures, We Must Test, Evaluate, Analyze, and PREDICT the Effects of Aging and Environmental Exposure

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DOT&E CONTRIBUTIONS

- Provides Objective and Independent Test and Evaluation Efforts & Oversight
- Substantiated R&D Investments and Production Commitments
- Reduced Design and Acquisition Risks Through Realistic Testing
- Recommended Corrective Follow on Actions When Suitability Is Not Demonstrated
- **All Essential to DoD**

DOT&E LIMITATIONS

DOT&E Guidance:

- Does not address potential performance degradation during the operational phase
- Does not include testing conditions that replicate or simulate aging effects
- Cannot provide assurance that system degradation will not affect lethality, reliability and safety throughout all logistics and operational phases

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TYPICAL WAR FIGHTER CONCERNS*

- **Is normal use/consumption still possible without risk to the user after the ammunition is returned from field conditions?**
- **Does returned ammunition have the same capability as 'normal' ammunition?**
- **Are the minimum conditions under which ammunition is currently checked during development sufficient for service use in an operational environment?**
- **Will it be necessary to define restrictions for operational use to ensure in-service safety?**
- **Does Ammunition Surveillance ensure unrestricted use?**
- **Should special field conditions and mission time be taken into consideration?**
- **Can undesirable changes to the ammunition be avoided by providing special storage conditions (air-conditioned containers or other storage modules)?**

*** Comments made by an Allied Warfighter after Deployment in Afghanistan/Iraq**

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ORDNANCE STORAGE IN AFGHANISTAN

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EFFECT OF DEGRADATION ON READINESS

- Degradation in Reliability and Performance Will Critically Affect In-Service Lethality and Kill Probability
- Current Inventory Requirements Rely on **As-Built P_k** Without Regard for Actual (degraded) P_k
- Use of Incorrect P_k Can Cause Planners and Warfighters to **Underestimate** Actual Ordnance Required for Missions. Simple Math:
  - 1000 Weapons at .95 R = 950 Effectives
  - 950 Effectives at .85 R Requires ~1120 Weapons

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EXAMPLES OF RELIABILITY DEGRADATION

Precedents for discounting the effectiveness of aging weapons when compared to "as-built" performance:

- **Soviet-made SA-2 surface-to-air missiles achieved a single-shot kill probability of about 1% during the Viet Nam war**
- **AIM-9E Sidewinder air-to-air missile achieved a 8% to 10% kill probability in Viet Nam**
- **AIM-7E Sparrow achieved a better but still disappointing 12% to 15% kill probability, versus the 70% demonstrated in initial or OT&E type tests**
- **During the Falklands the aging British Seacat surface-to-air missile achieved only a 10% kill probability while performance characteristics based on design and as-built reliability were significantly higher**

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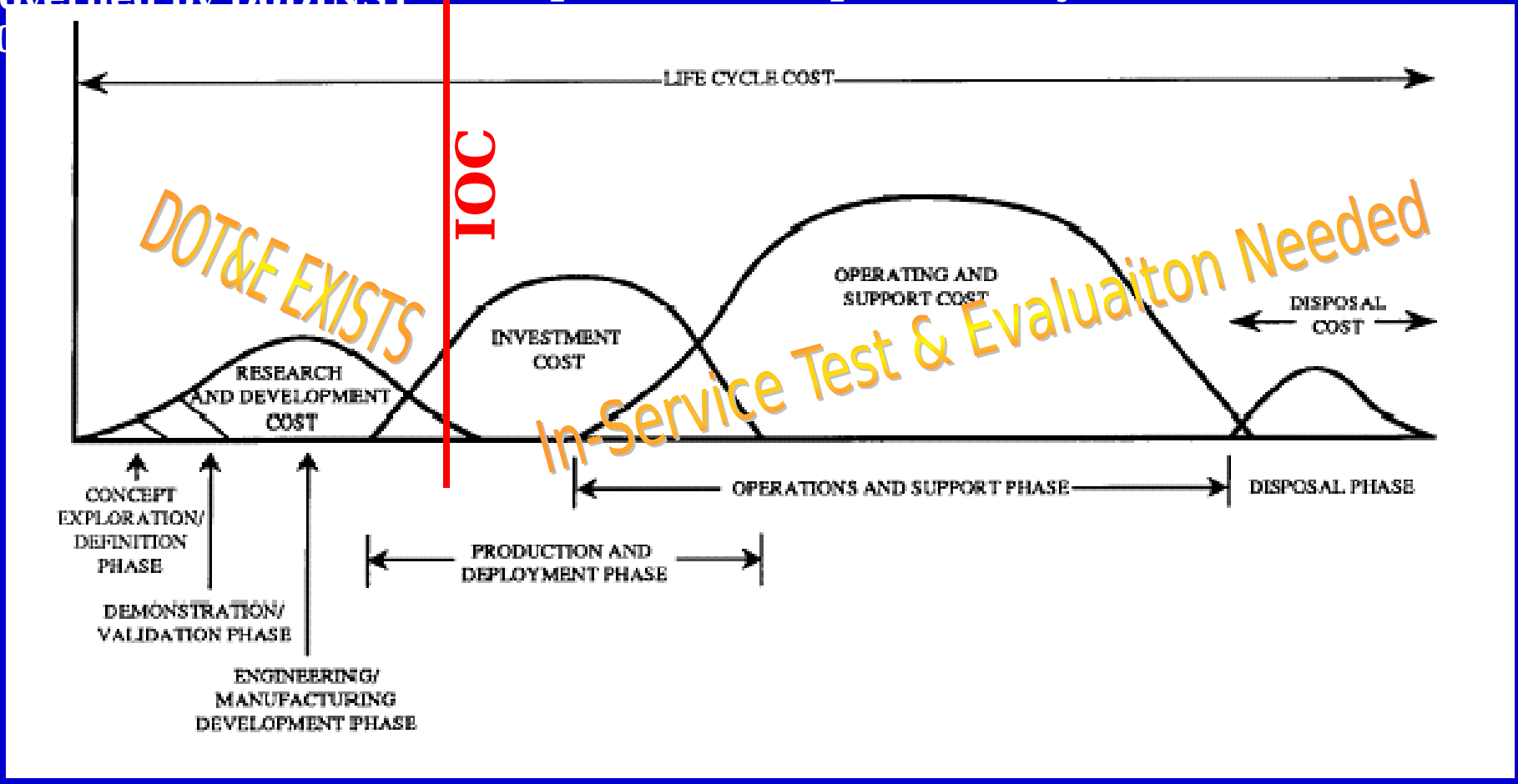
Test & Evaluation Discipline vs. Life Cycle Cost

Discipline for Independent T&E Governed by DoDINST 50

Independent T&E Not Mandated, Implemented Sporadically



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CONCLUSIONS

- To Ensure That a Weapon System Continues to Meet Operational Needs Throughout the Operational Phase of its Total Life Cycle, a Dedicated **In-Service Test and Evaluation (IST&E)** Program Must Continue Throughout that Life Cycle

- Weapon Replacement and Maintenance Programs Should be Predicated upon How Well the Current Inventory Satisfies Original Lethality, Reliability, and Performance Specifications

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RECOMMENDATIONS

- Ensure Robust **Total** Life-Cycle T&E
  - DT&E, OT&E & **IST&E**
  - IST&E Requirements be included in DoD 5000-series Instructions as a Part of the TEMP Requirement
  - IST&E be an Independent Program (e.g., QE)
  - IST&E Have DoD & Warfighter Oversight
- Weapon Replacement and Maintenance Programs be Predicated upon Total Life-Cycle Costs, With IST&E Results as a Significant Factor (i.e., Condition-Based Maintenance & Replacement)

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DIRECT FLEET BENEFITS

CONFIDENCE

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